



## JOINT MANAGEMENT PLAN REVIEW DRAFT ACTION PLAN: Coastal Development: Coastal Armoring

REVISED: May 13, 2003

---

***Please Note:** The MBNMS and the Sanctuary Advisory Council have tasked the management plan working groups with development of draft action plans that characterize the issue or problem and identify strategies and activities that address the issue. The working groups will develop these strategies and activities as they meet over the next several months. With this goal in mind, the progress of the group, the decisions, areas of agreement will be outlined in a progressively developed action plan identifying draft goals, issue characterizations, and strategies and activities. Members of the group as well as other interested parties should look to this draft action plan as it develops as a way of tracking the group's progress and decisions.*

### Introduction

About 85% of the California coast experiences active erosion due to natural, and anthropogenic causes. Storm damage continually erodes away at the coastline, most notably during El Niño years such as the 1982-83 episode, and other heavy storms <sup>1</sup>. This ongoing erosion, which is largely a natural occurrence, presents a threat to coastal development that has occurred in areas vulnerable to these processes. Hard surfaces such as concrete cover large portions of land, impede the natural absorption of water, and thus exacerbate surficial erosion on adjacent unprotected land. Furthermore, in some areas, natural sand transport to the coast has been decreased through the damming of streams and rivers. Increases in coastal development also have led to storm-related damage. A 1992 study by Griggs, Pepper and Jordan estimated that the cost of storm related damage and erosion, as well as structures used to mitigate the destruction throughout the state of California, averaged \$100 million annually <sup>2</sup>.

Shoreline protective structures have been used extensively along California's coastline to protect infrastructure and other development from wave action, or to retain soil to avoid erosion. Shoreline protective structures typically have been installed by private landowners or local, state, or federal governments, in an attempt to protect development that is threatened by erosion. Structures have also been installed in response to the need to protect public infrastructure such as Highway 1, which in some stretches, is vulnerable to erosion related to bluff retreat. This practice is commonly known as *coastal armoring*, and seawalls, bulkheads and revetments are some of the structures used for coastal armoring. Seawalls are barriers, usually vertical walls, between the land and water that protect from wave erosion. A bulkhead is used as a retainer, providing protection and

---

THIS DOCUMENT IS DRAFT WORK-IN-PROGRESS OF A  
MBNMS ADVISORY COUNCIL MANAGEMENT PLAN REVIEW WORKING GROUP

stabilizing the land that it supports. *Revetments* are protective structures placed along slopes and are constructed of a sturdy material such as stone<sup>3</sup>. With increases in development and continued, natural erosion of coastal bluffs, additional pressures will come to install structures both to access the coast and to protect private and public property from erosion.

The Army Corps of Engineers conducted an assessment of coastal armoring in 1971, and found that 3 miles of the coastline between the Santa Cruz/San Mateo county border, and Point Lobos in Monterey County was armored (all in the City of Santa Cruz). By 1978 armoring had increased to 9.6 miles, and by 1993, armoring had increased to 12 miles. A 1995 report of the California Coastal Commission (Commission) estimated that if trends continue, there would be as much as 27.7 miles of coastal armoring in the same area, in the future. The report stated that although only one-eighth of the study area was armored in 1995, one-third of the coastline has the potential to warrant future protection when considering land use patterns, and physical characteristics<sup>4</sup>.

The trends in Santa Cruz and Monterey Counties are typical of the state. By 1998, coastal armoring had been installed to protect about twelve percent (or almost one-eighth) of the coastline statewide. The mid and late 1980's was a period when a large amount of shoreline armoring was installed – in response to the 1982/83 El Niño and the major storms that occurred in 1986 and 1988. Between 1985 and 1990, forty-five miles of armoring was installed, costing an average of \$1,500 per foot (\$60 million/year)<sup>2</sup>. By 1998, California residents were paying more than \$75 million per year to armor the shoreline<sup>5</sup>. In a study conducted by Griggs et al., in 1992, it was determined that ocean front development has occurred in California, in the face of a large amount of scientific and empirical evidence regarding the risks of erosion. Griggs et al. concluded also that there was a large degree of inconsistency among existing state and local policies in addressing coastal hazards, and that there was a significant economic and local political influence shaping these policies<sup>2</sup>.

Development occurred in vulnerable areas along California's coast and there then follows a desire to protect both private and public property and infrastructure. The situation presents a serious predicament to both resource managers and property owners. However, it is clear that current policies need strengthening, and that there is a need to develop collaborative approaches to address the issues of erosion and the demand for coastal armoring, including improved guidance to enable better decision-making.

### **Impacts of Coastal Armoring:**

Environmental impacts of coastal armoring are both site specific and cumulative. The effects vary significantly depending on the type of structure constructed, the magnitude of the project, and the specific geological, biological, and oceanographic conditions in the

vicinity of the structure. Thus the impacts of an individual project need to be evaluated on a case-by-case basis. Coastal armoring can potentially damage or alter local coastal habitats, deprive beaches of sand, lead to accelerated erosion of adjacent beaches, hinder access and present problems with public safety.

As with any activity that alters natural processes, there can be significant long-term impacts related to coastal armoring. Currents, waves, and wind normally transport sediment throughout the littoral system. Armoring of the coast can interfere with littoral transport, which in a natural state may reach a dynamic equilibrium. When the availability of sediment is reduced due to the existence of a structure, erosion can increase in other nearby locations. This is due to starvation of the materials that would normally supply these areas. When a structure is constructed, a supply of sediment is effectively being cut off. Armoring also causes deflection of wave energy, which can accelerate erosion of nearby sites, and thus expand the need for shoreline armoring structures. In some cases, installing coastal armoring begets more coastal armoring. Furthermore, armoring can result in the loss of beach and intertidal areas through a process that has been termed “passive erosion.” Areas undergoing long-term net erosion experience a natural landward movement of the entire beach system during periods of sea level rise, such as has been the case for approximately the last 18,000 years. As cliffs and sand dunes retreat, the vacated area becomes part of the beach environment and the position of the beach shifts landward. Building a protective structure in front of a cliff or dune temporarily stabilizes the seaward location of the cliff or dune edge, however beach erosion continues. Since no new beach area is created through cliff or dune retreat, a net loss of beach area occurs. Ultimately, as erosion continues, this process also will result in the loss of the intertidal zone, as waves impact the seawall at all times, low tide as well as high.

Vertical structures in particular can deflect wave energy causing increased erosion and altering natural habitat in front of the structure. Reflected wave energy may make it difficult for organisms to inhabit the area because of high turbidity. Erosion caused by the reflection of wave energy is more severe with vertical structures than with curved, stepped, or inclined structures, which absorb or disperse the energy of the waves<sup>3</sup>. The significance of this reflected wave energy will vary, depending upon how frequently the wall is inundated or impacted by waves, and how much the reflective characteristics of the wall differ from the natural shoreline. A wall that is only subject to wave attack once a decade would only alter the reflected wave energy once a decade. Also, a vertical bluff and a vertical wall would have fairly similar reflective characteristics, while a dune and a vertical wall would be very different.

Potential biological impacts of coastal armoring include changes in abundance and distribution of species. Coastal armoring structures can influence the structure of benthic communities, due to potential differences in settlement patterns for natural substrates and armoring structures. Armoring structures can encroach into the intertidal, or disturb

important buffer areas such as marsh habitat between the marine and terrestrial environments, which naturally mitigate erosion, and play an important role in flushing of certain contaminants<sup>3</sup>. Certain structures can also provide habitat for predatory species not normally associated with the beach and intertidal zone such as rats and squirrels, which can feed on intertidal organisms, compete for food with native species, and transmit disease.

Seawalls can have recreational impacts as well, by blocking both vertical and lateral access to beaches, and altering wave patterns, which can negatively impact surfing conditions. Additionally, coastal armoring can act as a barrier to wildlife, by blocking access of certain species to the beach.

Environmental impacts that occur during the construction phase of coastal armoring projects are generally short term, lasting only a few days to a few weeks. Problems include increased turbidity caused by suspended solids in the immediate vicinity of the construction site, and the risk of chemicals or other materials entering the ocean from construction activities. Structures constructed in the intertidal zone have more impact than those constructed above the high tide line. Certain types of structures such as riprap revetments have fewer initial impacts than other hard structures, since construction normally requires significantly less excavation than, for example, a seawall. Permanent impacts of revetments however, are similar to those of seawalls, and the footprint of the revetment is typically larger. Many construction impacts can be minimized through appropriate mitigation. Mitigation measures include scheduling of the construction phase to reduce impacts by considering animal migration patterns, spawning patterns, etc, and specific actions such as the use of silt curtains.

### **How is MBNMS Currently Addressing Coastal Armoring?**

Sanctuary regulations prohibit alteration of the seabed, and all armoring structures placed below the mean high tide line require approval from the MBNMS. The Sanctuary regulates coastal armoring by authorizing Commission permits, and issuing specific conditions on those permits. Many seawalls have been constructed with no notification to or authorization from MBNMS. Since 1992, MBNMS review of seawalls primarily focused on minimizing impacts from the construction process rather than long-term impacts from the armoring itself. A major focus of this Action Plan is to conduct long-term planning as to the consequences of coastal armoring and its affect on some of the Sanctuary's most treasured resources, its beaches, bluffs, and coastline.

Since its designation, MBNMS has reviewed and authorized Commission permits for seawalls, riprap or other coastal armoring projects at 15 sites since its designation. Only a portion of the total coastal armoring projects underway in the region came to the Sanctuary for review, clearly indicating a need for improved inter-agency coordination. Of the permits reviewed by MBNMS, six were issued for extension and/or repair of existing seawalls, four for new seawall or revetment construction, two for road

stabilization projects to prevent bluff erosion, two for replacement of rip-rap with seawall, and one for stabilizing and adding to existing rip-rap. Eleven of these 15 permits were in Santa Cruz County, 3 were in San Luis Obispo County, and 1 was in Monterey County.

A NOAA response to a comment urging the Sanctuary to prohibit the construction of seawalls, in the MBNMS Final Environmental Impact Statement states: “Activities that require drilling into, dredging, or otherwise altering the seabed of the Sanctuary, or constructing, placing, or abandoning any structure, material, or other matter on the seabed of the Sanctuary are prohibited except as allowed under 15 CFR § 944.11 or exempted under activities related to the maintenance of harbors. Seawall construction would not be allowed.” This statement clearly indicates an intent to prohibit seawall construction that is inconsistent with current and past practices. Nonetheless, the regulations adopted for the Sanctuary allow Sanctuary management to allow development, otherwise prohibited, by “authorizing” other agencies’ permits, such as the Coastal Commission. There are three activities that MBNMS regulations expressly do not allow a sanctuary manager to permit—oil and gas development, designating new dredge disposal sites, and new sewage outfalls. The express regulatory prohibitions for which permits cannot be issued do not include seawalls. Thus MBNMS staff has interpreted this response to comment in the context of the regulatory framework set up in 1992.

Development along the coast increases the pressure to protect coastal structures with various types of coastal armoring such as seawalls, bulkheads and revetments to manage erosion. Approximately 14 miles of the approximately 290 miles of coastline is already armored in the MBNMS, and this amount is estimated to double if trends continue. In light of this situation, MBNMS staff recently initiated a joint evaluation of coastal armoring with the Commission, (1) to develop a more proactive, comprehensive regional approach, (2) to improve the current case by case permit system and (3) to strengthen coordination between the Commission and the MBNMS on coastal armoring permit review.

**Goal Statement:**

The goal of this workgroup is to devise a framework to minimize impacts to Sanctuary resources from coastal armoring, while recognizing the issue of protecting public and private property.

**Potential Management Strategies:**

The Sanctuary will work with its partners in implementing the following strategies and activities. While MBNMS will carry out some of the items independently, many strategies represent collaborative efforts that will be implemented in partnership with the various agencies and organizations involved in coastal armoring and coastal resource protection.

**STRATEGY I: Characterize the issue and determine information needs. Identify existing information and data gaps, and compile and produce scientific data and evaluation tools:**

Activities:

- A. Produce Sanctuary-wide maps and database for use as planning and permit review tools:
  - 1. Map existing coastal armoring sites and potential future site requests, for incorporation into B
  - 2. Develop regional integrated database and GIS layers showing land use types, parcels, coastal armoring locations, beach and bluff erosion rates, bottom types, biological habitats, geology/geomorphology, etc.
- B. Compile and analyze data:
  - 1. Assess individual and cumulative impacts of coastal armoring on sand supply dynamics, marine biological habitats and ecosystems, and public access
  - 2. Compile information on or conduct studies to estimate coastal bluff erosion rates, and shoreline change rates (Commission with NOAA Coastal Fellow)
  - 3. Compile or conduct regional evaluation of sand transport dynamics and beach nourishment
- C. Incorporate information from the above studies into maps and database from Activity A, and link to State of California's *Coastal Sediment Management Master Plan*
- D. Develop and implement a long-term monitoring program, to quantify and compare the impacts of different types of coastal armoring structures, in various habitat types and conditions. Considerations for monitoring program include intertidal biological community structure, changes in beaches, wave refraction patterns, and impacts on sand budget



**STRATEGY II: Develop a more proactive and comprehensive regional approach that minimizes the negative impacts of coastal armoring. Approach will consider short-term impacts throughout the life of the structure, including those related to construction and maintenance, as well as long-term cumulative impacts.**

Activities:

A. Develop a hierarchy of preferred responses to erosion that will include:

1. *Use of preventative measures:* Identify and evaluate preventative measures aimed at reducing the need for coastal armoring. Considerations may include increased setback requirements, incorporation of a “no hard armoring” policy (possibly in covenants, codes, and restrictions) for new subdivisions or situations when coastal agricultural land is converted to development, re-alignment of coastal roads and highways, and new setback requirements to be established for demolition/rebuild projects in urbanized areas
2. *Alternatives to coastal armoring:* Identify and evaluate alternatives to coastal armoring, including but not limited to: a) alternatives conforming to MBNMS regulations such as relocation of vulnerable structures, re-alignment of coastal infrastructure such as roads, bridges, and highways, and control of surficial erosion, and; b) alternatives not conforming to sanctuary regulations, including some sand supply strategies and artificial reef structures
3. *Preferred types of coastal armoring:* In cases where armoring is deemed necessary, identify and evaluate the least environmentally damaging types of coastal armoring, including more natural alternatives for specific conditions and geographic locations, taking into account engineering, environmental, aesthetic and public access concerns.

B. Develop guidelines for a sub-regional planning approach to coastal armoring—potential criteria could be: pristine or particularly sensitive areas where coastal armoring should be strongly discouraged or not allowed; urban zones which are already heavily armored and where efforts should focus on restoration and improved armoring techniques; and areas in-between where thorough case-by-case review and additional research is needed. Criteria to consider in developing guidelines include:

1. Biological sensitivity of habitats

2. Physical considerations including: geological units; sediment sources and sinks; beach nourishment needs; shoreline orientation; and erosion rates
  3. Development pressures including: extent of existing armoring; potential for new armoring requests; types of structures to be protected and; level of development and infrastructure
- C. Identify planning sub-regions and appropriate guidelines for each. Logical sub-regions might be only a mile or two in some urban areas such as Santa Cruz, but could range up to many miles for long stretches of rural coastline such as Big Sur.
1. Identify boundaries for sub-regions on map
  2. Consider measures from the hierarchy in *Strategy II; Activity A*, in determining priority approaches for each sub-region
- D. Develop a program for maintenance and restoration of existing armoring, including “clean-up” of poorly maintained sites, for both authorized and illegal structures.
1. When maintenance is requested, re-evaluate the need for protection. If protection is required, ensure that the proposed method is the least environmental damaging, and that appropriate mitigation of environmental impact is implemented.
  2. Incorporate improvements in beach access and public safety into maintenance and restoration program
  3. In heavily armored areas where maintenance is necessary and appropriate, consider the potential for installation of a comprehensive, uniform structure to replace multiple individual structures
- E. Develop a plan to reduce the use of and need for emergency permits through better predictive erosion analyses, potential alteration of current guidelines regarding initiation of work, and more proactive regional planning. Consider areas where it is appropriate to either initiate the work or develop alternative solutions, before the site becomes an emergency.
- F. Develop a multi-agency enforcement program to include inspection of permitted coastal armoring structures, tracking/notification and corrective action regarding illegal structures, and removal of emergency structures that are not permitted but remain in place



- G. If warranted based on above scientific evaluation, and needs assessment, develop an environmentally sound sand supply program for beaches, and develop and implement monitoring protocols for the program. Evaluate as potentially avoiding armoring or mitigating armoring. If deemed appropriate, such a program involving beach nourishment within MBNMS boundaries, will require future revision of Sanctuary regulations.
- H. Develop a system for tracking and distributing new information and scientific findings, as well as a system for updating and revising guidelines with this new information
- I. Investigate funding and partnership opportunities to implement plan, and take a more proactive approach in addressing coastal erosion

DRAFT

**STRATEGY III: Improve the current case-by-case permit system and strengthen coordination between the MBNMS and other agencies on coastal armoring permits:**

Activities:

- A. Where possible, link and integrate aspects of MBNMS coastal armoring plan with California state erosion policy and *Coastal Sediment Management Master Plan*
- B. Incorporate current MBNMS standard conditions regarding construction process into Commission permits
- C. Following the initiation of regional analysis from *Strategy II*:
  - 1. Identify permit conditions and authorization criteria of the agencies involved in the regulation of coastal armoring
  - 2. Compare typical multi-agency seawall permit conditions, identify and discuss selected discrepancies, and where possible rectify discrepancies
- D. Develop system for determining MBNMS level of involvement in small versus large projects, given severe staff constraints
  - 1. Develop threshold for full MBNMS review of selected projects based on overall footprint, location, and potential impacts, and ensure early communication on these projects
  - 2. Define threshold below which MBNMS does not individually review project, but relies on Commission permit review process to incorporate standard MBNMS conditions
- E. Improve early sharing of information on projects and permits among all relevant agencies

**STRATEGY IV: Training and implementation of regional program:**

Activities:

- A. Conduct needs assessment to determine best strategies for reaching target groups including: decision makers, agencies, coastal landowners, and coastal developers (investigate potential for collaboration with the National Estuarine Research Reserves Coastal Training Program workshops in conducting outreach and training programs)
- B. Give ongoing guidance to local, state, and Federal agencies, developers, and private property owners, about regional approaches to coastal armoring and promote guidelines
- C. Develop program for evaluating local and regional land use decisions where coastal development may negatively impact MBNMS resources
- D. Work with Local Coastal Program updates to improve existing policies, and incorporate these guidelines where possible

**DRAFT**

**Citations:**

<sup>1</sup> California Resources Agency. Draft Policy on Coastal Erosion Planning and Response and Background Material. March 2001.

<sup>2</sup> Griggs, Gary B., James E. Pepper and Martha E. Jordan, California's Coastal Hazards: A Critical Assessment of Existing Land-use Policies and Practices, California Policy Seminar, University of California, 1992.

<sup>3</sup> US Army Corps of Engineers. Engineer Manual. Design of Coastal Revetments Seawalls, and Bulkheads. 1995.

<sup>4</sup> California Coastal Commission. ReCAP Pilot Project Findings and Recommendations: Monterey Bay Region. September, 1995.

<sup>5</sup> Griggs, Gary. California Needs a Coastal Hazards Policy. Coast and Ocean Magazine. Volume 13, No. 3, 1998.

<http://www.coastalconservancy.ca.gov/coast&ocean/autumn98/a04.htm>

<sup>6</sup> Monterey Bay National Marine Sanctuary Final Environmental Impact Statement/Management Plan. Appendix F, Page 36. June 1992.

DRAFT